Q- An aluminum block is pushed to the right with and initial speed of v=10 ft/s at the same time a copper block is pushed to the left with an initial speed of v=16 ft/s. both blocks slide along a horizontal steel floor toward each other. if the blocks were initially 10 ft. apart determine how far each block slides before they collide. the kinetic friction for the aluminum block = 0.47 and the kinetic friction for the copper block = 0.36.

Time of motion for both blocks is the same, say it is t. When a body moves on a horizontal surface the normal reaction N is equal to its weight mg and friction force  $F = -\mu N = -\mu mg$ . Hence acceleration of the body will be  $-\mu g$ .

For aluminum block Initial velocity u = 10 ft/s Acceleration  $a_1 = -\mu g = -0.47*32 = -15.04$  ft/s<sup>2</sup>.

Hence distance covered in time t is given by the second equation of motion as  $\{s = ut + \frac{1}{2} at^2\}$ or  $s_1 = 10^*t + 0.5^*(-15.04)t^2 = 10^*t - 7.52^*t^2$ 

Similarly the distance covered by the copper block towards left is given by Initial velocity u = 16 ft/s Acceleration  $a_2 = -\mu' g = -0.36*32 = -11.52$  ft/s<sup>2</sup>.

Hence distance covered in time t is given by the second equation of motion as  $\{s = ut + \frac{1}{2} at^2\}$ or  $s_2 = 16*t + 0.5*(-11.52)t^2 = 16*t - 5.76*t^2$ 

As we know that the totals distance covered by both is 10 ft hence

or  $10 = 16^{*}t - 5.76^{*}t^{2} + 10^{*}t - 7.52^{*}t^{2}$  $13.28 t^{2} - 26 t + 10 = 0$ 

Using this formula for solution of quadratic equation we get

$$t = \frac{26 \pm \sqrt{26^2 - 4*13.28*10}}{2*13.28} = \frac{26 \pm \sqrt{144.8}}{26.56}$$

gives t = 1.432 s and t = 0.526 s

After collision the motion will not in the same pattern we have to take the shortest time and hence the time elapses before collision is 0.526 s

Distance covered by the aluminum block before collision will be

$$s_1 = 10^*t - 7.52^*t^2 = 5.26 - 2.08 = 3.18 \text{ ft}$$

And distance covered by the copper block before collision will be

$$s_2 = 16*t - 5.76*t^2 = 16*0.526 - 5.67*0.526^2 = 8.41 - 1.59 = 6.82$$
 ft